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Do-It-Yourself Environmental Sensing

Radka Peterová [a], Jakub Hybler [b]

[a] *Charles University, U Kříže 8, Praha 5, 158 00, Czech Republic*
[b] *Czech Technical University, Technická 2, Praha 6, 158 00, Czech Republic*

Abstract

This paper presents an ongoing research project proposing a DIY environmental sensing approach that empowers citizens to reinvigorate their awareness of, and concern for, pollution. To test the thesis, PAIR, a prototype with interchangeable gas sensor, was developed. Our main focus was on sensing environment on-the-go to provide users with immediate feedback. Finally, we identify the main benefits amateur data collection and participatory sensing represent for urban dwellers.

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Keywords: citizen science; participatory sensing; air-pollution monitoring; DIY environmental sensing; technology democratization; amateur data collection

1. Introduction

Air pollution is one of the most important factors currently affecting quality of life in big cities. However, despite the fact that poor air quality has been shown to directly affect human health, our daily exposure to such pollutants has been inadequately captured and publicly shared [1]. There are state agencies measuring the air quality and informing citizens in the press or on their websites, but usually individuals are not fully aware of their personal exposure, either immediate or long-term. However, the lack of awareness is not only caused by ineffective methods of communication from the state agencies; it is also the type of data that their fixed sensors provide.

2. Citizen science

Participatory Sensing is described as a revolutionary new paradigm that allows people to voluntarily sense their environment using readily available sensor devices such as smart phones, and share this information using existing cellular and internet communication infrastructure [2]. Democratization of technology, low-cost sensors and Do-It-Yourself (DIY) hardware prototyping platforms, have the potential to enable everyday citizens to develop and use personalized air quality sensing tools and turn their mobile phones or PDAs to measuring devices enabling us to learn about our environment. These innovative sensing capabilities bring new possibilities for individuals to take part in air-quality monitoring as well as to raise awareness of environmental issues. It also brings new possibilities for citizen science so that researchers can make use of the potential of masses and collect data in larger quantities from locations that were never monitored before.

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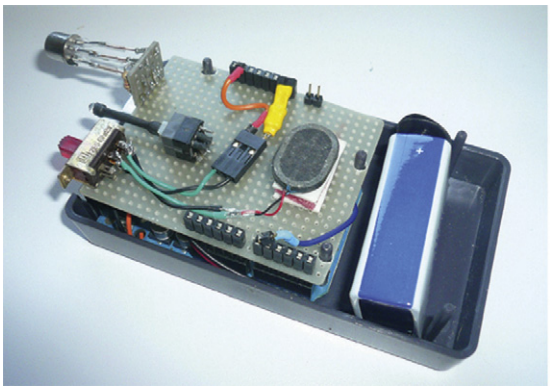


Fig. 1. (a) PAIR – environmental sensing device prototype; (b) air pollution sampling in Prague – Libuš.

3. PAIR

To address the above mentioned issues, we developed a measuring device prototype called PAIR, see Fig. 1. It is a hardware and software initiative to bring pollution monitoring closer to everyday citizens-scientists and give them a tool to measure their environment on everyday basis. We claim DIY environmental monitoring can lead to a better recognition of a connection between polluters (pollution sources), pollution and health risks as well as necessary prevention.

4. Amateur data collection

Our goal is to enhance the public awareness and understanding, initiate a discussion about scientific topic that have direct impact on our lives and to extend the principles of democracy to the production of (scientific) knowledge. Some of the advantages that citizen science projects within the field of air-pollution monitoring share in common involve (a) opportunity to examine air quality at a more localized resolution, (b) increased environmental knowledge as well as increased environmental awareness, (c) opportunity for researchers thousands of mobile sensors gathering rich sets of local data at almost no cost, and (d) possibility to highlight past activities in the area which could have left an environmental footprint

5. Conclusion

Air pollution data from official governmental agencies doesn't bring enough fine-grained data important to raise air pollution awareness among individuals and it doesn't provide people suffering from respiratory problems with the personalized information they need about the places they go to and about their exposure. However, democratization of technology and connection of mobile devices with low-cost sensors promise an alternative way, DIY environmental sensing that augments the official knowledge and allows a relatively accurate estimate of an individual's exposure.

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